Food Insecurity

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Introduction

Concepts and Terms

Food security is inherently unobservable and difficult to define, but both intrinsically and instrumentally important. Humans have a physiological need for the nutrients supplied by food. Food is therefore a crucial input into performance and well-being. Many development programs, projects and policies therefore include food security objectives. But food is also a source of pleasure apart from its physiological necessity. Since both biological needs for food and psychic satisfaction from food vary markedly among and within populations, it is difficult to pin down precise, operationalizable measures of food security. Moreover, the concept of food security encompasses more than current nutritional status, capturing as well vulnerability to future disruptions in one's access to adequate and appropriate food (Barrett 2002). This forward-looking, uncertainty-based dimension of food security adds further complexity to the concept.

This complexity has given rise to scores, if not hundreds, of different definitions of the term "food security". Definitions have evolved with thinking about the proximate manifestations and direct and indirect causes and consequences of "food insecurity", the complement to "food security". But there remain much variation and imprecision in these terms as used in practice.

The current prevailing definition, agreed upon at the 1996 World Food Summit, is "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." Food insecurity exists when this condition is not met. Of course, by that standard, the world has only known food insecurity.

Food security is commonly conceptualized as resting on three pillars: availability, access, and utilization. As Webb et al. (2006) note, these concepts are inherently hierarchical, with availability necessary but not sufficient to ensure access, which is in turn necessary but not sufficient for effective utilization. Availability reflects the supply side of the food security concept. In order for all people to have "sufficient" food, there must be adequate availability. But adequate supplies do not ensure universal access to "sufficient, safe and nutritious food", nor do they ensure that the food to which people have access is used to its full potential to advance human health and well-being.

Hence the second pillar of the food security concept: access. Access is most closely related to social science concepts of individual or household well-being: what is the range of food choices open to the person(s)? It reflects the demand side of food security, especially as manifest in the role "food preferences" plays in the definition of food security. This is meant to capture cultural limitations on what foods are consistent with a population's prevailing values. Two people from different traditions with access to exactly the same diet might not consider themselves equally food secure given variation in religiously or culturally determined food tastes. Inter- and intra-household distributional questions also influence access.

Utilization reflects concerns about whether individuals and households make good use of their food access. Do they acquire nutritionally essential foods that they can afford or do they forego nutrient intake in favor of consumption of an inadequately varied diet, of non-food goods and services, or of investment in their future livelihoods? Are the foods they purchase safe and properly prepared, under sanitary conditions, so as to enjoy their full nutritional value? Do individuals have adequate access to preventive and

curative health care so as to be free of diseases that can limit their ability to absorb and metabolize essential nutrients? In particular, over the past generation, widespread concerns have arisen about micronutrient deficiencies associated with inadequate intake of essential minerals such as iodine, iron or zinc, and vitamins, in particular A and D.

Some agencies, such as the United Nations Food Agriculture Organization (FAO), consider stability to be a fourth dimension of food security. Stability captures the susceptibility of individuals to food security due to interruptions in access, availability or utilization. Certain individuals within communities or households may be more vulnerable to instability and are at greater risk of food insecurity. This matters for targeting of interventions and the design of safety nets intended to safeguard food security for vulnerable subpopulations.

The temporal aspect of stability links to the oft-made distinction between chronic and transitory food insecurity. Chronic food insecurity reflects a long-term lack of access to adequate food, and is typically associated with structural problems of availability, access or utilization. Transitory food insecurity, by contrast, is associated with sudden and temporary disruptions in availability, access or, less commonly, utilization. The most common transitory food insecurity is seasonal, recurring quite predictably, especially among rural populations during the period preceding harvest, when grain stocks run low and food prices typically hit annual peaks (Devereux et al. 2008). Some transitory food insecurity is regular but not periodic, as in the case of regular droughts that routinely strike semi-arid regions. The most serious episodes of transitory food insecurity are commonly labeled “famine”, which is itself an elusive concept typically, but not always,

associated with a critical food shortage, mass undernutrition or starvation, and excess mortality (Devereux 1993).

It is worth briefly noting that although the terms are often used interchangeably, “hunger”, “undernutrition” and “malnutrition” are distinct, albeit related concepts. Technically, hunger refers to the physical discomfort caused by a lack of food. Undernutrition relates to nutritional status – typically evaluated using anthropometric measures described below – at least two standard deviations below expected levels. Malnutrition refers to undernutrition and its complement, obesity. In popular discussions, these terms are often used synonymously with “food insecurity”.

Historical Overview of Food Insecurity

For most of human history, lives were short and unhealthy due in large measure to insufficient nutrient intake. Thomas Malthus’ well-known explanation for this predicament was that human population growth routinely overtaxed the capacity of the Earth to provide sufficient food, leading to routine food insecurity and regular famines.

Since the 18th century, however, a few dozen countries have enjoyed an unprecedented escape from hunger and premature death due largely to dramatic advances in food availability and associated income growth broadened access to a satisfactory diet. Synergistic interactions arise as eating more requires increased food production, which becomes more feasible as people grow bigger, stronger, healthier and more energetic because they eat more – of course, only up to a point now commonly exceeded in an era of exploding obesity. The reinforcing feedback between nutritional status and productivity points to a nutritional poverty trap. Several scholars argue that the escape

from the nutritional poverty trap helped to catalyze the unprecedentedly rapid and widespread advance of living standards over the past 300 years (Dasgupta 1993; 1997; Fogel 2004).

Much of this progress traces back to increased food availability made possible by agricultural technological change associated with plant breeding, improved agronomic practices such as intercropping and crop rotations, irrigation, and the emergence of mechanical implements and chemical fertilizers. As a direct result, food security has often been equated with food availability indicators, typically measured in terms of satisfaction of dietary energy requirements, i.e., calories per person per day. Indeed, at the time of the World Food Conference of 1974, food security was widely viewed as a problem of insufficient and unstable production. And because domestic food production represents the overwhelming majority of food availability in virtually every country, increased variability in domestic food production significantly increases national-level food consumption instability (Diakosavvas 1989).

Such measures create an inherent conceptual link to food self-sufficiency, i.e., whether a country produced enough food to feed its population adequately. However, self-sufficiency implies letting the domestic market equilibrate local demand and supply, which can often lead to high prices. Strictly availability-based measures pay scant attention to the economic (in)efficiency or environmental consequences of producing one's own diet rather than trading internationally for food according to economic laws of comparative advantage based on natural resource endowments.

Moreover, there must be ample food for all, but distributional problems commonly lead to food insecurity despite sufficient aggregate food availability. This is

true at the national level as well as the individual level. Although food is plentiful at the global level, food availability is insufficient in some poor countries, especially without significant external assistance. International trade is helpful, but of limited use in relieving aggregate food insecurity in some low-income countries because limited export earning and international borrowing capacity constrain current account deficits.

Over the past quarter century, the major shift in thinking about food insecurity has therefore been towards the close linkage between poverty and vulnerability (rather than low agricultural productivity) and food insecurity, to emphasize consumption rather than production. This second generation of thinking on food security, focused more on the demand side and on issues of access by vulnerable people to food, stems directly from the pathbreaking work of Sen (1981), whose famous opening sentences underscore that "starvation is the characteristic of some people not *having* enough food to eat. It is not the characteristic of there *being* not enough food to eat. While the latter can be a cause of the former, it is but one of many *possible* causes" (Sen 1981:1, emphasis in original). Ironically, Sen explicitly eschewed the concept of food security, focusing instead on the "entitlements" of individuals and households. Sen's seminal work helped shift the focus from supply side issues associated with aggregate food availability toward the levels of individual and household access to food, and thus to the role of (perhaps idiosyncratic) demand failure brought about by lost employment, adverse movement in the terms of trade, production failure, termination of transfers, or other forms of "entitlement failure". Sen's concept of "entitlements" represents the commodity bundles that a person can rightfully make her own, through production, trade, or transfers. Sen (1981) explains hunger as the failure of an individual's entitlements to provide a commodity bundle

offering sufficient nutrients, and famine as the result of widespread entitlement failures. Sen thus placed increased emphasis on not only traditional economic variables of incomes and prices, but equally on human rights and on the legal institutions of the state, as well as the moral and social norms of cultures.

The entitlements approach has been critiqued by some as apolitical, ahistorical, excessively legalistic and economistic (de Waal 1990; Baro & Dubel 2006). Recent analysts have encouraged efforts to incorporate power and vulnerability into conceptualizations of food insecurity, although these have gained little traction. One consequence has been increased focus on understanding the proximate threats to food security in an integrated fashion. The emergent third generation view of food security builds on food availability and entitlements as a summary of food access. Chambers (1989, p. 1) identifies two dimensions of food insecurity: "an external side of risks, shocks and stress to which an individual or household is subject; and an internal side which is defenselessness, meaning a lack of means to cope without damaging loss". Individuals with excessive risk exposure and without access to noninjurious coping mechanisms are the most food insecure. Both risk exposure and the availability of noninjurious coping mechanisms depend heavily on structural patterns of control of (financial, human, and natural) resources and on access to markets, technologies, and finance. Food security is thus closely related to poverty and to social, economic, and political disenfranchisement (Drèze & Sen 1989).

Food Insecurity Today

The United Nations' Food and Agriculture Organization (FAO) estimates that 923 million people were seriously undernourished in 2007 (FAO 2008). This oft-critiqued estimate provides only a snapshot of those suffering from insufficient macronutrient intake at any given moment. Meanwhile, the World Bank estimates that 1.4 billion people lived on US$1/day or less in 2005 (Chen & Ravallion 2008). The relative proximity of those two estimates drives home the inextricable relation between extreme poverty and severe undernourishment. Indeed, the two are directly coupled in the first Millennium Development Goal - to halve the proportion of people living in extreme poverty and hunger by 2015 - agreed by 189 countries in the United Nations' 2000 Millennium Declaration. Food insecurity remains widespread today in large measure because extreme poverty remains widespread, and vice versa.

Most food insecurity is chronic. FAO (2006) reports that only 8 percent of hunger-related deaths worldwide in 2004 were caused by humanitarian emergencies, while 92 percent were associated with chronic hunger and malnutrition. Food insecurity exists in OECD countries. For example, in any given year, the U.S. Department of Agriculture estimates that roughly ten percent of U.S. households are food insecure, with approximately one-third of these households experiencing moderate to severe hunger. Nonetheless, well in excess of 90 percent of the food insecure inhabit developing countries.

Food insecurity has worsened in some countries during the past fifteen years, while others have experienced relatively rapid economic growth, but continue to have high rates of food insecurity (e.g., India). Figure 1 depicts changes in undernutrition for key countries and subregions between 1990 and 2005. The extraordinary heterogeneity of

experience comes through clearly. In China and Southeast Asia, there are tens of millions fewer people suffering undernutrition than there were only 15 years ago and rates of undernutrition have fallen sharply as well. In other regions, including South Asia, east and southern Africa, undernutrition rates have fallen even while the number of people suffering undernutrition has increased due to population growth. And in some regions (e.g., central Africa) both numbers and rates have increased.

Figure 1: Changes in Undernutrition by Sub-region between 1990-92 and 2003-05

Recent volatility in food and fuel prices revived public interest in food insecurity. A further 105 million people may experience food insecurity due to volatile prices and erosion of purchasing power (Quisumbing et al. 2008). Such estimates underscore the difficulty of estimating how many – and which – people suffer food insecurity.

Food Insecurity Measurement

What one measures and how necessarily heavily influences how or if one intervenes to support food security objectives. Because food security is an inherently unobservable and relatively elusive concept, measurement issues preoccupy much of the academic and "grey" literature. The literature offers quite a range of approaches to measuring food insecurity. These vary by unit of analysis: individual, household, community, country, continent, or world. Food insecurity measures can be most productively grouped based on whether they track availability, access, or utilization.

Availability

Food security measures at the national level tend to focus on aggregate availability by estimating production, stock levels and import capacities of countries. Such figures are commonly summarized in food balance sheets, such as those reported regularly by FAO. Food availability measures tend to be leading indicators in that they reflect supply fluctuations that sometimes affect prices and food consumption, especially by the poor. Barrett and Maxwell (2005) emphasize that these simple indicators underscore how many countries – about 30 percent – continue to suffer serious shortfalls in food availability in this world of plenty.

Availability measures necessarily concentrate on relatively macro-scale levels of analysis, typically countries or international regions. At their most disaggregated scales, for example as operationalized in emergency needs assessments by agencies responding to disasters, food availability estimates are made for subnational regions or agroecological zones. The problem, of course, is that aggregate estimates suppress variation within the country or region. Because concerns about food insecurity are typically rooted in the experience of individuals and households, availability measures alone rarely motivate interventions of any sort today. Further, most of the frontier research on food security measurement is taking place at more disaggregated levels of analysis, focusing especially on the access pillar of food security.

Access

Maxwell et al. (2008) argue that the multidimensionality of adequate access to food makes identifying access indicators difficult. Livelihoods-based measures are one class of indicators that attempt to holistically identify and monitor the activities, assets, and capabilities necessary to sustain a means of living. The Southern African

Development Community's Vulnerability Assessment Committees, Save the Children UK's Household Economy Approach, and the Coping Strategy Index monitor livelihoods and the causes and responses to food insecurity at household levels. Other related measures of food access include the Household Food Insecurity Access Scale, expenditure and consumption studies, and dietary diversity measures (Maxwell et al. 2008).

Terms of trade and prices are another class of access indicators. When prices change far more quickly than incomes, people, especially the poor, face greater risk of food insecurity. A key challenge of using food prices as indicators is that most of the world's food insecure are rural households that depend, to some degree, on agriculture for their incomes. Yet, most poor farmers are also net buyers of food. Food insecure agrarian populations commonly benefit in the short run from lower food prices even though this may harm them in the longer term (Barrett 2002; 2008). Figure 2 shows for a sample of seven countries that very few households are net food sellers, even in low-income agrarian nations. Thus the effects of price changes can be difficult to interpret without understanding who are at risk of food insecurity, how they earn incomes, when they utilize markets, and what they consume.

Figure 2: Distribution of Poor Net Buyers/Sellers of Staple Foods

Many measures assess *household* access, yet food insecurity is experienced by *individuals*. Measuring food security at aggregate levels of households or districts suppresses within-group variability and can mask pockets of food insecurity. Of particular concern, cultural practices and intrahousehold dynamics can result in sharply differential access to food within households, by gender and/or age, leading to substantial

understatement of undernutrition by measures that rely exclusively on household or higher-level aggregates (Haddad et al. 1996).

Utilization

Utilization measures capture individual food insecurity through the use of food intake measures, anthropometric indicators, and assessments of caring practices. Food intake measures based on recall data tend to underestimate consumption, while direct observation is extremely time consuming and expensive. Dietary diversity scores are one common alternative increasingly employed by food security and nutrition analysts.

Another strategy is to employ anthropometric measures such as weight-for-height, or height-for-age Z-scores – the former indicating "wasting" or short-term nutritional deprivation, the latter indicating "stunting" or long-term undernutrition – as well as weight-for-age, body mass index and mid-upper arm circumference. The first three measures are only intended to assess the nutritional status of children, typically those under 60 months of age. The virtue of anthropometric measures is that they are quite easily measured, standardized and interpreted against international benchmarks, as compared to measures that rely on greater subjectivity during data collection or interpretation. However, anthropometric data are costly and time consuming to collect, and are vulnerable to poor field measurement procedures. Furthermore, for all anthropometric measures, poor status may be the result of poor health (e.g., parasitic infection, diarrheal disease) and not to nutritional availability, access or utilization concerns, substantially complicating prescriptive interpretation of such measures (Barrett 2002; Maxwell et al. 2008).

Measures of village and household cleanliness and sanitation, child caring and feeding practices, health, food quality, and maternal nutrition education are commonly used as indicators of effective utilization of food (Reed et al. 1996; Arimond & Ruel 2002). Molds or fungi can affect the quality of foods, such as aflatoxin, a carcinogenic and immunosuppressive mycotoxin to which as many as 4.5 billion people are routinely exposed through contaminated food supplies (Williams et al. 2004). Individuals who are ill or cannot access clean water may not effectively absorb the nutrients they consume. Feeding practices are a key determinant of infant and young child malnutrition, especially breastfeeding during the first six months of life (Horton et al. 2008).

Effective utilization of food requires both adequate macronutrients – calories, energy, and fat – and micronutrients (i.e., essential vitamins and minerals). As the importance of micronutrients has become better understood, food intake measures have expanded beyond macronutrients to incorporate measures of micronutrient deficiencies. Horton et al. (2008) argue that iodine, vitamin A, and iron are the "big three" deficiencies, although zinc, folate, thiamin (B1), riboflavin (B2), niacin (B3) and vitamin C deficiencies can also adversely affect nutritional status (Maxwell et al. 2008). The more nutrients one tries to track, however, the greater the complexity of food insecurity measures. Further, requiring sufficient intake of each nutrient as necessary for food security increases the nutrient-level resolution of measurement and necessarily increases the number of people considered food insecure. For example, oft-cited FAO measures of hunger are based only on estimates of macronutrient intake; including essential micronutrients such as iodine, iron and vitamin A commonly doubles or even triples estimates of the population suffering food insecurity (Barrett 2002).

Research on Measurement

Food insecurity can be triangulated by employing multiple indicators to capture access, availability and utilization across time and across levels of aggregation. However, triangulation may not be operationally feasible due to the time sensitive nature of food insecurity response and resource constraints. The optimal food security measures to employ depend on the type of food insecurity – chronic or transitory – the likely affected populations, and the stability of the situation, among other considerations. Measures requiring careful and expensive data collection may be less appropriate when responding to rapid onset food transitory insecurity associated with sudden natural disasters (e.g., earthquakes, hurricanes) as compared to situations of chronic or recurring food insecurity.

Consistent interpretation of data emerging from a variety of sources poses an additional challenge in food security measurement (Maxwell et al. 2008). The Integrated Food Security and Humanitarian Phase Classification system was developed to aid in cross-context comparisons by synthesizing and mapping findings from multiple data sources. Research on the tradeoffs across accuracy, time, and cost and on refining and streamlining data collection and analysis remains valuable not only for identifying rapid and effective indicators but also for the insight such research can provide into intervention options.

A particularly important area for additional research concerns improvements to early warning systems (EWS), which aim to track key food security indicators and provide months-ahead warning to decision-makers of possible impending food crises.

The primary clients for EWS are governments and international humanitarian agencies. The use of information and communication technologies is rapidly changing EWS practice, including greater dissemination of early warning information directly to vulnerable or food insecure households. Emergent EWS tools include months-ahead statistical forecasting of nutritional status so as to cue interventions (Mude et al. in press).

Threats to Food Security

Understanding of the threats to food security – i.e., the causes of food insecurity – has become steadily more refined as thinking about food security has advanced from a first generation focus on aggregate food availability, through a second generation emphasizing individual- and household-level access to food, toward a third generation conceptualization that places food security in a broader framework related to risk, access to health care and a broader range of micronutrients, and other factors that affect the ability of food intake to ensure a healthful existence. Food insecurity has multiple causes which coexist at the individual, household, community, and national levels. A solid understanding of the ("covariate") causes of food insecurity that are common to a broad subpopulation (due, for example, to crop yields, food prices, wages, civil unrest) is essential to generalized interventions (e.g., food aid, famine early warning systems) and to long-term, aggregate improvement in food security at the level of communities, countries and regions. Meanwhile, an understanding of the individual-level ("idiosyncratic") causes of food insecurity is essential to successful targeting of interventions to particular food insecure persons. For this reason, we divide the remainder of this section between covariate and idiosyncratic threats to food security.

Covariate threats to food security

A large majority of the world's population depends on markets for access to food. Adverse movements in the terms of trade between purchased food and the goods or services they produce and sell (including wage labor) can cause entitlements failures. On the other hand, many net food sellers are poor themselves, and declining relative food prices hurt them. This is the essence of the "food price dilemma" (Timmer et al. 1983): higher food prices are necessary to induce increased local food production and to increase the incomes of poor, net seller food producers, yet high food prices threaten the food security of low-income consumers. The dilemma is complicated further by the observation that a large proportion of smallholder food producers are net food buyers, as shown in Figure 2.

In fact, most people in any country – even highly agrarian ones – are net food buyers. Urbanization is steadily reinforcing this pattern. As a direct consequence, perhaps the gravest covariate threat to food security arises due to food price spikes. Price spikes can emerge from sharp, adverse movement in global markets, as occurred during the 2007-8 global food price crisis, and affect many people in multiple countries simultaneously. The nature of food storage – that speculators buy and hold stocks when prices are low, sell those stocks when prices rise, and stocks can never go negative – means that the prices of storable food commodities are prone to occasional upward spikes, but not to opposing plunges (Williams & Wright 1990). Price spikes can be catastrophic for poor populations, who commonly spend half or more of their total income on food.

Over the past several decades, global increases in food productivity have far outstripped demand expansion, leading to declining real food prices, i.e., favorable changes in the terms of trade for most net food purchasers. Nevertheless, over the past decade or so agricultural productivity growth rates have been declining, such that significant increases in demand arising from income growth (largely in Asia) and from the growing use of crops for biofuels production has outpaced supply growth recently, leading to declining grain stocks worldwide and rising prices.

Episodically, food prices can increase sharply, especially where markets are poorly integrated or noncompetitive. Then a local supply shock – including a shock caused by speculative storage that removes commodity from the market temporarily (Ravallion 1987) – can precipitate price spikes that can trigger acute, widespread food insecurity. Those most at risk lack reliable access to markets, impairing their ability to smooth consumption. Market access is impeded primarily by excessive transactions costs, including the absence of good market information, hence the disproportionate concentration of the food insecure in areas with rudimentary communications, storage, and transport infrastructure. Macroeconomic problems such as binding foreign exchange constraints or trade barriers often exacerbate more localized problems. When current production fails and markets do not function well, those with sufficient stocks of liquid assets or directly consumable foods can persevere; the asset poor cannot. Rapid asset depreciation – whether grain stored interseasonally by peasants, shelters that deteriorate rapidly in city slums, or cash that loses value in a hyperinflationary economy – effectively renders people asset poor unless their net savings rates are high. Consumable or liquid assets offer individuals the ability to smooth consumption over time, thus

guarding against both life cycle changes in productivity and transitory shocks to real income or food availability. This is also true at the aggregate level, where a nation's grain stocks and foreign exchange reserves play a central role in maintaining food availability and stable domestic food prices in the face of global market price fluctuations.

The possibility of price spikes caused by localized supply shortfalls returns attention to the question of food availability. Many places that suffer widespread chronic food insecurity due so because the high costs of food marketing make food locally nontradable (Barrett 2008) and local agricultural production is relatively unproductive. The wide range of reasons for low crop and animal productivity in developing country agriculture are well known, ranging from depleted soil nutrients, lack of reliable water supplies, high pest and disease incidence, lack of improved cultivars well-adapted to local agroecological stressors, poor input distribution systems, etc. (Sanchez 2002). Because domestic food production dwarfs cross-border commercial food trade or international food aid shipments (Figure 3), domestic agricultural productivity arguably remains the primary cause of chronic food insecurity in low-income countries.

Figure 3: Global Annual Cereal Flows

While low productivity often triggers price spikes, multiple factors, including "herd psychology" can turn a price spike based on demand and supply fundamentals into a price bubble. In 2007-08, increased food and biofuel demand, high fuel prices, US dollar depreciation, and adverse weather all fed rising international food prices. But governments, individuals and investors, reacting to rising prices, purchased more, creating a "positive feedback loop" causing a price bubble (Robles et al. 2009). Governments restricted exports, built or held stocks, and controlled prices, thereby

decreasing the flow of commodities into international markets and fueling international price spikes. Additionally, precautionary storage by individuals, farmers and traders to protect against further price increases and the speculative behavior of investors drove price increases even higher (Robles et al. 2009; Timmer 2009).

The number of natural disasters annually worldwide has roughly quadrupled in the past 25 years, while the number of persons affected by disasters has roughly tripled over the same period, according to data available in the International Emergency Disasters Database (http://www.emdat.be/). As a direct consequence, the number of food emergencies worldwide has doubled, on average, over the past two decades, from 15 to 30 per year, with most of the increase occurring in Africa, where they have tripled (FAO 2006). As scientists increasingly predict more frequent extreme climate events due to anthropogenic climate change, the prospect of more frequent, severe, local supply disruptions raises concerns in much of the developing world.

Disaster affected peoples routinely depend on transfers. But unrequited transfers are generally not enforceable rights, so transfer-dependent populations constantly face the threat of inadvertent or intentional disruption of entitlements. Transfer dependence is the principal reason why food insecurity is disproportionately concentrated among children and the elderly, especially children. Because labor productivity is low at either end of the life cycle, and because children's asset holdings are typically negligible, these groups commonly lack capacity to self-provision in food. Social security systems that guarantee entitlements – whether formal, state-sponsored ones, or informal familial and social reciprocity arrangements – may affect remedies to food insecurity among the transfer dependent. But few if any schemes provide full insurance against food insecurity.

Food insecurity is also inversely related to sociopolitical stability. The security of property rights against confiscation or theft is an important determinant of the value of one's assets. Poverty is often associated with weak states, and civil disruption that creates added risks, including greater market risk since weak markets commonly accompany weak states. Dramatic political transitions leave many people vulnerable, as has been true in recent years in countries such as Afghanistan, Haiti and Zimbabwe. Such transitions often lead to devastating disruption of marketing channels, production systems, and traditional social security systems, particularly when accompanied by civil strife.

Indeed, conflict displaces huge numbers of people and was a primary cause in nearly half of the 20th century famines in Africa (Devereux & Maxwell 2001). According to the International Federation of Red Cross and Red Crescent Societies (2008), in 2008 there were 36.7 million refugees (persons seeking refuge in another country) or internally displaced persons (driven from their homes to temporary settlements within their country). As Collier (2007) emphasizes, nearly three-quarters of the poorest billion people on Earth live in countries that have recently endured, or are still in the midst of, a civil war. Conflict not only destroys lives and livelihoods, it disrupts markets, production cycles and humanitarian operations. The resulting misery and desperation too often begets a vicious circle; as Collier points out, the best predictor of suffering civil conflict is having experienced it previously. Chronic food insecurity is thus all too commonly the result of conflict.

Idiosyncratic threats to food security

While some situations – price spikes, civil war, etc. – may cause food insecurity for many individuals, even in communities that are food secure in aggregate, inevitably some individuals are food insecure for idiosyncratic reasons. Perhaps the biggest factor driving individual and household-level food insecurity is relative poverty. Meager asset holdings and earnings leave people disadvantaged in the marketplace, both for earning an income and for affording food that better endowed individuals are likewise demanding. As Jayne et al. (2003) document, land holdings are becoming more concentrated throughout Africa and the developing world, and most variation in per capita farm sizes occurs within-village rather than between-village. Thus, it is the heterogeneity within communities that accounts for a large share of poverty and food insecurity.

Relative poverty is commonly associated with individual characteristics that are associated with social exclusion that likewise causes individual level food insecurity. Ethnicity, religion, gender, caste or recent in-migration often lead to individuals suffering worse terms of trade, having poorer access to common property resources, such as land or water, essential to achieving self-sufficiency in food, or simply falling through the holes in incomplete social solidarity networks (Barrett 2005a). Whether by virtue of discrimination or marginalization, those with less voice and power within communities are typically more vulnerable to suffering hunger and food insecurity (Chambers 1989).

Disparities in wealth and immutable individual characteristics are not the only reason for within-community, idiosyncratic variation in food security. Using detailed household history detail for tens of thousands of households across multiple countries, Krishna (2007) finds that ill health and high healthcare costs constitute overwhelmingly the most important reason for households' descents into poverty and food insecurity. Of

course, the misfortune of ill health is related to poverty and exclusion, which limit one's ability to invest in preventive or curative health care, one's access to health care and to informal assistance, and thus magnify the effects of health shocks on food security.

Poverty and Food Insecurity Traps

Whether the shocks are covariate or idiosyncratic, a sudden, dramatic collapse of food availability or access can cause permanent problems – in the extreme case, death – even if the underlying disruption – of food prices, local agricultural production, employment, etc. – is short-lived. The permanent consequences of transitory phenomena arise due to the existence of poverty traps (Dasgupta 1997; Barrett 2005b; Carter & Barrett 2006). As a burgeoning literature on poverty dynamics emphasizes, there is a fundamental difference between opening up a pathway out of poverty and blocking a slide into poverty, between "cargo net" interventions that people can use to climb or be lifted over obstacles, and 'safety net" interventions that preserve productive assets – not least of which human capital – so as to enable independent recovery once the shock has passed (Barrett 2005b; Carter & Barrett 2006). Cargo nets relate to asset accumulation and productivity improvement, while safety nets revolve around asset protection.

Acutely food insecure poor people must often liquidate productive assets compromising future well-being in order to survive today, although considerable and growing evidence on coping strategies demonstrates the lengths to which they commonly go to protect assets (Barrett 2002). The most vulnerable members of shock-affected populations – children and women, in particular – typically suffer disproportionately from food consumption shortfalls during episodes of acute food insecurity, often

suffering even when other members of the household are able to cushion themselves against shocks (Hoddinott 2006). Short-term deprivation, especially among very young children in formative stages of cognitive and physiological development, too often leads to permanent impairment of performance and earning potential. A child's permanent impairment commonly means that his or her suffering is transmitted later to his or her own children, fostering intergenerational transmission of poverty and chronic food insecurity.

The various threats to food security we have identified – low labor productivity, adverse terms of trade, limited market access, asset poverty, restricted borrowing capacity, the absence of a reliable safety net to provide transfers, living with conflict – point to four stylized groups that are extraordinarily food insecure (chronically or transitorily). The first group is workers (urban and rural), who suffer when food prices increase or money wages or employment rates decrease precipitously. The second group is smallholder farmers, particularly in rainfed agriculture, who face the threat of harvest failure or of adverse movements in the terms of trade between those commodities they sell and those they purchase. The third is pastoralists in arid and semiarid regions, whose livestock are not only their primary sources of food and income but also their main store of wealth in an environment of thin or missing financial markets that is especially prone to violence. Livestock productivity and value both fall precipitously in times of disease, drought or flood, leading to considerable seasonal and regular food insecurity among almost all pastoralists, even those not chronically food insecure. The fourth group is children and pensioners threatened by the simultaneous dismantling of preexisting safety

nets and food subsidies, as occurred in many formerly socialist states following the fall and dissolution of the Soviet Union.

Interventions aimed at enhancing food security are commonly targeted at one or more of those groups. We now turn to discussion of the wide range of mechanisms employed by governments, charitable organizations and others in an effort to address food insecurity, whatever its cause.

Mechanisms to Promote Food Security

Just as the causes of food insecurity are varied, so are the available responses. There is increasing recognition that the underlying causes of food insecurity can rarely be addressed by a single intervention (Pinstrup-Andersen & Herforth 2008). Yet, reaching consensus on the most effective and efficient combinations of external responses is elusive. Understanding under what conditions certain responses fail or succeed, whether interventions reach intended populations, what unintended consequences may result, which activities are complementary or competing, and what the costs, benefits and timeliness of interventions are remain core topics of ongoing research on food insecurity.

Individual Responses to Food Insecurity

Food insecure individuals facing constraints choose between consumption of food and other necessities while simultaneously choosing between food security now and in the future. These tradeoffs can result in behaviors that adversely affect current food security. To ensure the viability of their future livelihoods, individuals may choose food insecurity rather than sell productive assets. Similarly, individuals may sell their food aid

rations in order to buy other necessities, or spend less time on childcare in order to generate income (Reed & Habicht 1998; Paolisso et al. 2001). Uncertainty and exposure to risk can also impact individuals' livelihood strategy choices. Food insecure individuals often choose less risky, but lower reward, strategies that keep them vulnerable (Barrett 2002).

Various subpopulations are also affected by food insecurity differently. Women have different resources to draw from than men (Quisumbing et al. 2008). Chronic or severe acute food insecurity can result in irreversible cognitive or physical damage, leading to increased health expenditures, lost labor productivity, or even mortality (Barrett 2002). These irreversible effects of food insecurity can lead to negative feedback loops or poverty traps of the sort just described: low-level equilibria from which households cannot escape without external assistance.

Understanding and accounting for individuals' responses to food insecurity can enhance the efficacy of interventions. The Coping Strategies Index, a food security measure, monitors households' responses to declining food security, finding that coping strategies (e.g., from rationing food intake to selling productive assets) can be grouped consistently across countries by severity (Devereux et al. 2008; Maxwell et al. 2008). A systems approach can clarify the connections between agricultural productivity, ecosystems, food insecurity and behaviors in the face of food insecurity (Barrett 2002; Pinstrup-Andersen & Herforth 2008). Dynamic systems modeling may provide insights into households' responses to food insecurity threats, and may be especially useful for understanding the effects of climate change on household food security.

Increasing Availability: Agricultural Development

Food availability is a necessary condition to food security and remains distressingly limited in many countries. A common approach to improving availability is increasing agricultural productivity, which can improve food security for rural producers, landless laborers, and consumers. Historically, interest in and funding for agricultural development has been fickle. And even within the domain of agricultural development, substantially different approaches exist – e.g., those rooted in policy reform or in technology development or in improved natural resources management – and are driven by differing assessments of the binding constraints to increasing productivity and the appropriate responses to these constraints. Most commonly, agricultural development interventions focus on stimulating technical change in agricultural production. There are, however, parallel efforts at improving smallholder organization, decreasing transactions costs of marketing, and improving access to appropriate technologies and productive assets so as to stimulate smallholder market participation (Barrett 2008). Securing property and water rights, developing infrastructure, minimizing storage loss, ensuring quality, aligning marketing incentives and trade policies, and providing extension services or financial services such as microinsurance or credit are other interventions intended to improve food availability.

Promoting Access: Economic Growth and Markets

Economic growth is associated with improved food security. Yet, the benefits of growth can be distributed unevenly across households, with many facing continued food insecurity (Ahmed et al. 2007). Figure 4 presents a cross-sectional scatterplot of national

level child wasting and stunting rates against 2006 per capita gross national product, along with the fitted logarithmic regression line representing the best statistical approximation of the relation between income and child nutritional status. In almost every country, stunting rates are approximately double the wasting rates, reinforcing the point that most food insecurity is chronic in nature. Further, rates of child undernutrition fall rapidly with increases in average income, reflecting the strong relation between poverty and food insecurity. Finally, compared to 1995 (see Barrett 2002), children living in middle-income and upper-income countries are faring dramatically better, likely reflecting improved healthcare, sanitation, and caring practices.

Figure 4: Child Stunting and Wasting, by National Income

Economic growth thus is one strategy for reducing food insecurity. The drivers of economic growth remain hotly contested, however (Collier 2007). Macroeconomic and sociopolitical stability, rates of investment in productive assets – not least of which human capital – and effectively functioning financial markets all appear to be important components in achieving economic growth. Just as the drivers of economic growth are a subject of widespread dispute, so is the effectiveness of different policies intended to support economic growth, such as international trade policies and structural adjustment programs (Ahmed et al. 2007).

Economic growth is clearly not a sinecure. Timmer (2005) finds that economic growth in tandem with food price stabilization polices led to improved food security, particularly in East and Southeast Asia. Many governments routinely intervene in food markets to try to influence prices and ensure food access, in part for humanitarian and food security reasons, in part to safeguard their political support. Yet, food market

interventions through price controls, subsidies, tariffs, strategic grain reserves, or trade restrictions remain contentious. Such interventions tend to be both expensive to sustain and can have adverse effects on markets, although the extent of the adverse effects continues to be debated (Knudsen & Nash 1990; Timmer 2005; WFP 2009). Alternatives to direct intervention in food markets focus on decreasing the price gap between consumers and producers, for example by lowering transactions costs and enhancing private competition by improving infrastructure, information, access to credit, and storage.

Sharply fluctuating prices suggest weak underlying food storage and marketing systems and can be a proxy indicator of food insecurity (Timmer 1989; Barrett 2002). While higher prices harm access and lower prices hinder availability, volatile prices cause economy-wide disincentives. Unstable prices discourage human and physical capital investment by producers, impose transactions costs on consumers, and increase the riskiness of investments throughout the market chain (Timmer 1989). Macroeconomic stabilization programs can encourage investments in productivity and protect poor households from price spikes.

Findings from the 2007-08 food price crisis suggest that international coordination to end speculative hoarding, such as releasing reserve stocks, may help discourage international price speculation. For example, the 2007-08 rice price bubble was “pricked” when Japan, with international encouragement, announced in June 2008 that it would sell surplus rice. By late August 2008, rice prices were half of what they had been in April of that same year (Timmer 2009).

Promoting Access: Assistance Programs

Assistance programs, intended to alleviate immediate food insecurity through transfers, range from cash distribution, to food stamps or vouchers, to food aid delivery, to food banks, to ration cards, to delivery of agricultural inputs, to school lunch programs, to supplementary and therapeutic feeding programs. Barrett (2002) reviews a wide range of these food assistance programs, the theory behind them, and the empirical evidence on their performance.

In developing countries, a traditional response to food insecurity has been food aid donated to low-income, food-deficit countries by high-income, typically agricultural surplus nations. Since the mid-1950s, the United States has consistently donated more than half of global food aid in any given year. Food aid volumes are, however, tiny compared to domestic food production in developing countries, or even to international commercial food trade, as reflected in Figure 3. And food aid volumes have been falling over the past twenty years as donor countries increasingly find more flexible and efficient means of responding to food insecurity in low-income countries (Barrett & Maxwell 2005).

Food aid has been critiqued as outdated and inefficient. One problem is that food aid is budgeted in monetary, not physical units. Therefore, the amount of food provided depends on food prices and transportation costs, resulting in aid volumes that vary inversely with need. Less aid is available during poor production years, when prices are higher, which typically coincides with greater need. Perhaps most importantly, food aid deliveries from the United States, the main donor, average five months, often arriving too

late to respond effectively to rapid onset emergencies or arriving after recovery has begun, potentially contributing to price volatility (Barrett & Maxwell 2005).

More recently, some donors have decoupled their food security work from domestic agricultural policies, distributing more cash and less food aid. Humanitarian agencies and governments are increasingly demonstrating the successful use of transfers other than transoceanic food aid when responding to food insecurity (Barrett et al. 2009). Some agencies also advocate for a flexible portfolio of responses including cash, locally or regionally procured food, food vouchers, agricultural inputs, or financial instruments such as microfinance, microinsurance for households, and index insurance and forward contracting for donors (Chantarat et al. 2007; Barrett et al. 2009).

The relative merits of various transfers depend on local context: for example, market functioning, intrahousehold bargaining, leakages, the populations at risk, and program objectives all influence the relative efficacy of transfer types. To identify the most appropriate form of transfer requires analyses of the situation, the needs, and responses as well as greater donor flexibility (Maxwell et al. 2008; Barrett et al. 2009).

Perhaps the most important factor in determining the efficacy of food security interventions is the quality of targeting: do instruments reach intended beneficiaries (Lentz & Barrett 2008)? Good targeting is exceedingly difficult. For example, labor constrained households may not be able to participate in food-for-work programs, and the neediest, socially excluded individuals might not be easily identified, even in participatory or community-based targeting efforts. Targeting is usually based on a mixture of indicators, such as geographic location, observable individual or household characteristics, income, assets, program restrictions (such as work requirements), or

through consultations with community members or key informants. Identifying who should be targeted for assistance and what form of assistance will be most effective involves trade-offs across time, efficacy, and cost (Barrett 2002; Barrett & Maxwell 2005).

Rights-based advocates, such as La Via Campesina's food sovereignty movement, India's Right to Food Campaign, and the Food and Agriculture Organization's Voluntary Guidelines to Support the Progressive Realization of the Right to Adequate Food in the Context of National Food Security, are leading a resurgent interest in developing social protection programs to provide regular, continued support to those facing chronic food insecurity. Social protection advocates argue that some households need long-term, state-sponsored support (e.g., elderly individuals, disabled individuals, orphans, households with HIV-AIDS positive members, communities facing seasonal hunger). Several developing countries implement social protection programs, such as the Productive Safety Net Program in Ethiopia, the Hunger Safety Net Program in Kenya, Bolsa Familia in Brazil and Oportunidades in Mexico. Most OECD countries have similar, targeted social protection programs.

Devereux (2009) argues that governments and agencies routinely suffer 'response failures' in halting or incompetent attempts to respond to food insecurity resulting from supply or demand crises; such failures commonly result in worsening food insecurity. Poorly conceptualized or implemented assistance programs can adversely affect communities, leaving them more vulnerable to food insecurity by displacing commercial trade, affecting local prices, fostering undesirable dependency, or distorting incentives and behaviors. These adverse consequences of assistance are often linked to poor

targeting, inappropriate responses, or lags in delivery. Improving the efficacy of assistance programs remains a critically important step in addressing “response failures”.

Improving Utilization

Delivery of micronutrients and improving caring practices, particularly through breastfeeding promotion, appear to be among the most cost effective approaches to reducing undernutrition and food insecurity, especially for young children (Horton et al. 2008). Micronutrients can be delivered through several mechanisms. Fortifying complementary foods, such as iodizing salt, can effectively address micronutrient deficiencies common across large populations (Horton et al. 2008). Diets can be also be supplemented with the delivery of additional rations or specific micronutrients, such as iron supplements for pregnant or lactating women. With varying success, some social protection programs have mainstreamed utilization initiatives by providing fortified complementary foods and/or nutrition education (Horton et al. 2008; Leroy et al. 2008).

Supplementary feeding programs provide supplemental foods to moderately malnourished individuals either as take home-rations or in on-site feeding programs. Distributions of ready-to-use-therapeutic food (RUTF) – calorie-dense, micronutrient rich foods such as “Plumpy-nut” – and blanket distributions of special foods during pre-harvest or lean seasons can be effective at addressing moderate malnutrition although the success of these programs has been mixed (Devereux et al. 2008; Navarro-Colorado et al. 2008).

Therapeutic feeding programs provide in-patient medical and feeding services for severely undernourished individuals. In the innovative community-based management of

acute malnutrition (CMAM) models, communities screen their own members and most acutely malnourished individuals are treated in an outpatient environment. In-patient services are typically restricted to individuals with medical complications or infants less than six months old. CMAM lowers detection and implementation costs and decreases opportunity costs for families who would otherwise travel to centralized in-patient facilities (Devereux et al. 2008).

Access to nutrition education may reduce vulnerability to hunger. Maternal nutrition education can influence child nutritional status, but the effects differ by socioeconomic status (Reed et al. 1996). Good caring practices related to child feeding and the use of preventative health services can compensate for poverty and low maternal schooling (Ruel et al. 1999). The many health benefits of breastfeeding are well known. Yet only slightly more than one-third of infants in developing countries are exclusively breastfed for the first six months of life, in part because of competing demands on mothers' time in low-income households (Horton et al. 2008). Therefore, research on breastfeeding promotion uptake is ongoing (Horton et al. 2008)

Other interventions can support utilization and micronutrient delivery. Improving storage and post-harvest handling can improve food safety and quality. Biofortification, the breeding of staple crops for higher nutritional content, is a potential longer-term, cost-effective solution to chronic micronutrient deficiencies. Improving access to sanitation and clean water, and providing health care are two common interventions that can improve utilization of food. In turn, good nutrition can decrease the risks of infection and illness. Kadiyala and Gillespie (2003) find that better nutrition improves the health status

of individuals infected with HIV, and decreases the likelihood of mothers transmitting HIV to their children.

With billions of people worldwide currently or prospectively suffering shortfalls in their ability to access and use sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life, food insecurity remains a serious global challenge. Research in this area cuts across disciplinary lines and international boundaries. At this point in time, understanding of the causes of food insecurity is reasonably advanced. The biggest current research challenges surround the measurement of food insecurity and the identification and evaluation of which interventions work best and under what circumstances.

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